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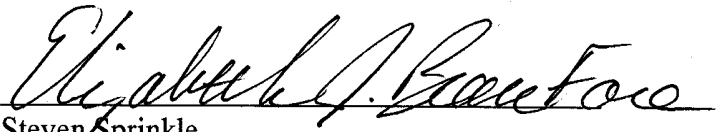
§

JURY DEMANDED

Pursuant to the Special Master's request for supplemental expert declarations regarding issues related to claim construction, Plaintiff Crossroads Systems, Inc. respectfully submits the attached expert Supplemental Declaration of John Levy, Ph.D. with accompanying exhibits.

Dated: March 8, 2011

Respectfully submitted,

By: 

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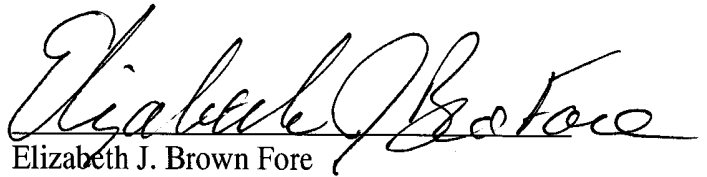
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Elizabeth J. Brown Fore

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
AUSTIN DIVISION

CROSSROADS SYSTEMS, INC.,	§	
	§	
Plaintiff,	§	
	§	CIVIL ACTION NO. 1:10-CV-652-SS
v.	§	
	§	JURY DEMANDED
(1) 3PAR, INC.,	§	
(2) AMERICAN MEGATRENDS, INC.,	§	
(3) RORKE DATA, INC.,	§	
(4) D-LINK SYSTEMS, INC.,	§	
(5) CHELSIO COMMUNICATIONS, INC.,	§	
(a Delaware Corporation),	§	
(6) ISTOR NETWORKS, INC., and	§	
(7) CHELSIO COMMUNICATION, INC.,	§	
(a California Corporation),	§	
	§	
Defendants.	§	

SUPPLEMENTAL DECLARATION OF JOHN LEVY, Ph.D.

I, John Levy, Ph.D., make the following declaration based on my own personal knowledge and, if called to testify before the court, could and would testify as follows:

1. Attached hereto are true and correct copies of:

Exhibit A: *NFS Version 3 Protocol Specification*, Internet Engineering Steering Group, RFC 1813, June, 1995;

Exhibit B: *NFS Version 3 Design and Implementation* by Pawlowski et al., USENIX Summer 1994, June 9, 1994;

Exhibit C: Portions of *Fibre Channel – Gigabit Communications and I/O for Computer Networks*, by Alan F. Benner, McGraw-Hill, 1996, p. 17 (Figure 2.1 – Fibre Channel Structural Hierarchy);

Exhibit D: Portions of *American National Standard for Information Technology- Fibre Channel-Arbitrated Loop (FC-AL)*, ANSI X3.272-1996;

Exhibit E: *SCSI-3 Block Commands (SBC)*, ANSI NCITS 306-1998;

Exhibit F: *Fibre Channel Protocol for SCSI (FCP)*, ANSI INCITS 269-1996;

Exhibit G: Portions of *International Standard for Information Technology – High-Performance Parallel Interface – Part 1: Mechanical, Electrical and Signaling Protocol Specification (HIPPI-PH)*, ISO/IEC 11518-1-1995;

Exhibit H: Portions of *American National Standard for Information Technology- Small Computer System Interface-2*, ANSI INCITS 131-1994 (R1999);

Exhibit I: *ISO/OSI, IEEE 802.2, and TCP/IP* by Tao Zhou, 1997, <http://www.windowsitpro.com/article/tcpip/iso-osi-ieee-802-2-and-tcp-ip.aspx>;

Exhibit J: *Storage Vendors Push the Capacity Envelope: Infoworld* October 27, 1997 Volume 19, Issue 43, p. 48;

Exhibit K: *Internet Small Computer Systems Interface (iSCSI)*, Internet Engineering Task Force RFC 3720, April, 2004;

Exhibit L: *OSI Reference Model—The ISO Model of Architecture for Open Systems Interconnection*, by Hubert Zimmermann, IEEE Transactions on Communications, vol. COM-28, no. 4, April, 1980.

NLLBP and “Allow Access . . . Using NLLBP”

2. The term native low level block protocol (“NLLBP”) is not a term of art. The Patents-In-Suit describe a NLLBP:

station. The workstation provides a file system structure, that includes security controls, with access to the local storage device through native low level, block protocols. These protocols map directly to the mechanisms used by the 45 storage device and consist of data requests without security controls. Network interconnects typically provide access for

Col. 1, ll. 42-47.¹

3. A person of ordinary skill in the art at the time of filing (the filing date of Dec. 31, 1997 of United States Patent No. 5,941,972) would understand from the specification that an NLLBP is a protocol used to access a local storage device that is appropriate for that device.

Additionally, the Patents-In-Suit describe that:

tions more easily. This is accomplished without limiting the performance of workstations 58 because storage access involves native low level, block protocols and does not involve the overhead of high level protocols and file systems required by network servers.

Col. 5, ll. 1-5.

4. Therefore, a person of ordinary skill in the art at the time of filing would understand that NLLBPs do not involve the overhead of high level protocols and file systems typically required by network servers.

5. The Patents-In-Suit also use the term “network protocol.” The Patents-In-Suit state, for example:

remote network server. The remote network server provides file system structure, access control, and other miscellaneous 50 capabilities that include the network interface. Access to data through the network server is through network protocols that the server must translate into low level requests to the storage device. A workstation with access to the server

Col. 1, ll. 49-54.

¹ All cites are to United States Patent No. 6,425,035 (the “’035 Patent”) unless otherwise specified.

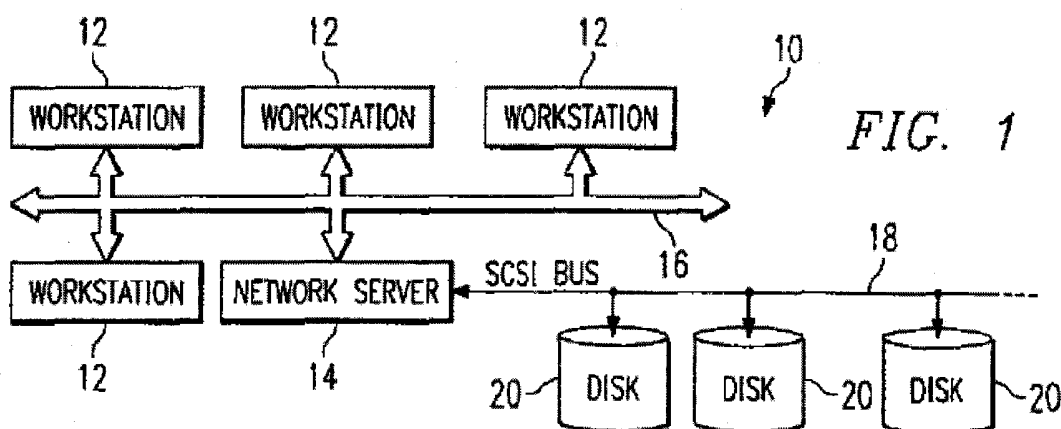
6. Thus, according to the Patents-In-Suit, a network protocol is a protocol that is used to access data through a network server, which the network server must then translate into low level requests to the storage device. The Patents-In-Suit specifically describe what is translated:

through native low level, block protocols. On the other hand, access by a workstation 12 to storage devices 20 requires the participation of network server 14 which implements a file system and transfers data to workstations 12 only through high level file system protocols. Only network server 14 communicates with storage devices 20 via native low level, block protocols. Consequently, the network access by work-

Col. 3, ll. 17-23.

7. A person of ordinary skill in the art at the time of filing would understand that it is data access requests in high level file system protocols that are translated into low level requests to access data on storage devices. Therefore, a person of ordinary skill in the art at the time of filing would understand that a “network protocol” as used in the Patents-In-Suit is a protocol used to access data on a network server that includes high level file system protocols that are translated into low level requests by the network server in order to access storage.

8. To provide additional context, Figure 1 of the Patents-In-Suit illustrates a conventional network that provides access to storage devices through a network server.



9. To better understand how data is transferred in systems such as those depicted in Figure 1, some background on the operation of networks is helpful. This background is meant to provide a high-level understanding. Networks are best understood as having layers. Each layer uses the facilities and features of the layer below it. Conversely, each layer provides other, typically more abstract, facilities and features to the layer above it. Each layer in a network defines a protocol establishing rules for interaction between (two or more) devices connected through the network.

10. To provide a more specific example based on Figure 1, a network server 14 can be a network file server providing file access services to the networked workstations 12 and, for example, transferring information using Network File System (NFS), Remote Procedure Call (RPC) and Transmission Control Protocol / Internet Protocol (TCP/IP) protocols on the network. The network layers of the example of Figure 1, in which network server 14 uses NFS/RPC and TCP/IP protocols over an Ethernet network transport medium 16, can be visualized as shown in Table 1 below.

<i>Network Layer</i>	<i>Typical usage</i>	<i>Purpose</i>
Network Application	Network File System (NFS)	File access commands / responses
Presentation/Session	Remote Procedure Call (RPC)	Invoke remote software / return response
Transport/Network	“datagram” delivery – addressing, routing, disassembly to and reassembly from packets (TCP/IP)	Encapsulate messages
Data Link / Physical	Data framing, hardware addressing, electrical signaling (Ethernet)	Deliver packets

Table 1

See e.g., Ex. A, *NFS Version 3 Protocol Specification*, Internet Engineering Steering Group, RFC 1813, June, 1995; Ex. B, *NFS Version 3 Design and Implementation* by Pawlowski et al., USENIX Summer 1994, June 9, 1994; Ex. L, *OSI Reference Model—The ISO Model of Architecture for Open Systems Interconnection*, by Hubert Zimmermann, IEEE Transactions on Communications, vol. COM-28, no. 4, April, 1980, p. 425 (Abstract); Ex. I, *ISO/OSI, IEEE 802.2, and TCP/IP* by Tao Zhou, 1997, <http://www.windowsitpro.com/article/tcpip/iso-osi-ieee-802-2-and-tcp-ip.aspx>.

11. In the example using the network layers of Table 1 above for the example of Figure 1, a workstation 12 has a local file system that interacts with a network file system in network server 14 using the Network File System (NFS) protocol. The workstation 12 local file system composes commands in the NFS command language.

12. When a program in a workstation 12 wants to access remote files (files whose data is stored on remote storage devices), a file system program in the workstation 12 composes NFS commands to be sent to the network server 14. These commands invoke software procedures in the network server 14 using Remote Procedure Calls (RPCs), which are encapsulated into TCP/IP messages, which are in turn broken into packets for transmission over the Ethernet network transport medium 16. The network server 14 receives packets over the Ethernet network transport medium 16, reassembles the packets into messages using the TCP/IP layer, and extracts RPCs from the messages. The RPCs then invoke software procedures in network server 14 associated with the NFS commands. To perform file access on behalf of workstation users, the network server 14 maintains file directory and file allocation information in files of its own and issues low level requests to storage devices 20 to access locally stored data in its own files and in workstation users' files.

13. A person of ordinary skill in the art at the time of filing would understand that TCP/IP and Ethernet are used to transport high level network file system requests in NFS/RPC, and it is the high level network file system requests in NFS/RPC that are translated by network server 14 into low level requests to access storage. A person of ordinary skill in the art at the time filing would appreciate that TCP/IP protocol cannot be translated into low level requests in order to access storage, because TCP/IP is concerned only with delivery of messages, without regard for the content or meaning of the messages. Likewise, Ethernet (Data Link / Physical layer) protocol cannot be translated into low level requests to access storage, because Ethernet (Data Link / Physical layer) is concerned only with the delivery of packets over the Ethernet cable and electrical interconnection, without regard for the meaning of the content of the packets.

14. Furthermore, I find it clear that the patentees in the Reexamination of the '035 Patent used the terms "network protocol," and "high level protocols" to refer to protocols that include high level file system protocols (for example a network file system request in NFS/RPC or other network file system request) that require translation at the network server into low level requests to access storage.

15. Figure 3 of the Patents-In-Suit depicts one embodiment of a storage network incorporating the invention of the '035 Patent.

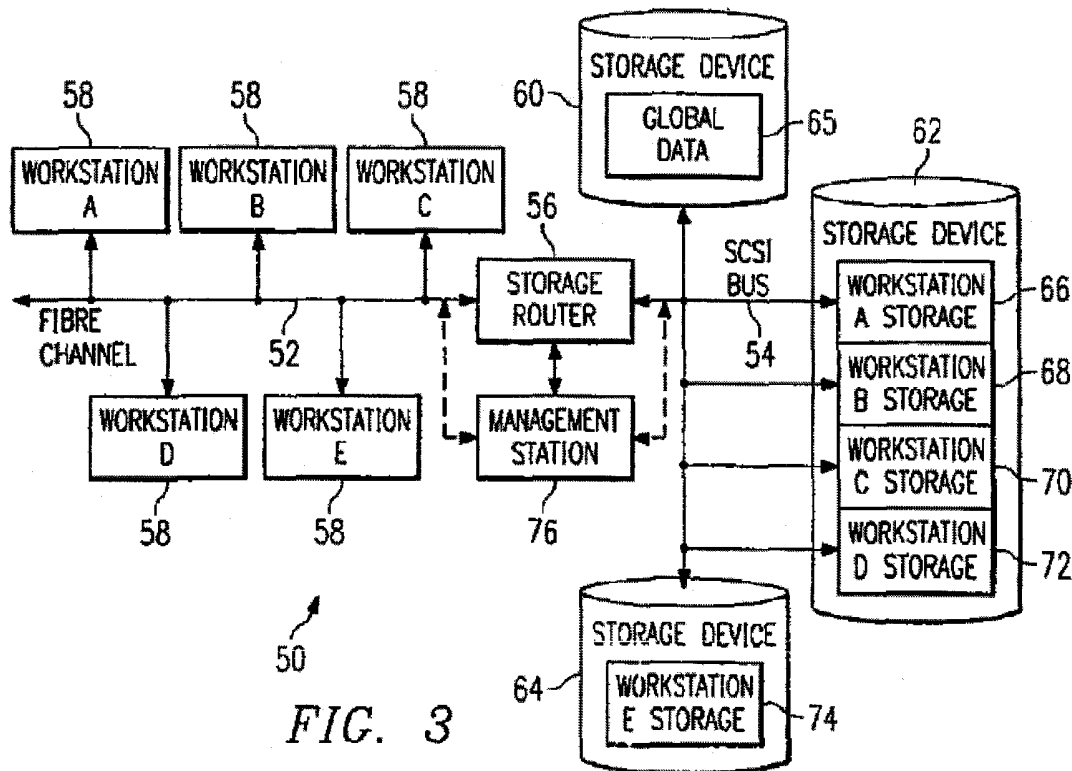


FIG. 3

16. As described in the '035 Patent:

FIG. 3 is a block diagram of one embodiment of a storage network, indicated generally at 50, with a storage router that provides virtual local storage. Similar to that of FIG. 2, storage network 50 includes a Fiber Channel high speed serial interconnect 52 and a SCSI bus 54 bridged by a storage router 56. Storage router 56 of FIG. 3 provides for a large number of workstations 58 to be interconnected on a common storage transport and to access common storage devices 60, 62 and 64 through native low level, block protocols.

Col. 3, l. 64-Col. 4, l. 6

17. In the example of Figure 3, storage router 56 provides access to data on remote storage devices 60, 62 and 64 for workstations 58, using NLLBP (SCSI commands in SCSI FCP (FC4)) transported using Fibre Channel network protocol (FC2) over a Fibre Channel high speed serial interconnect 52 (FC1/FC0). The network layers for this example can be visualized as shown in Table 2 below.

<i>Network Layers</i>	<i>Typical usage</i>	<i>Purpose</i>
Protocol mapping	SCSI FCP (FC4)	SCSI-3 command for storage access
Common Services	(FC3)	
Network	Message addressing & routing (FC2)	Encapsulate messages
Data Link / Physical	electrical signaling (FC1/FC0)	Deliver data

Table 2

See e.g., Ex. F *Fibre Channel Protocol for SCSI (SCSI FCP)*, ANSI NCITS 269-1996; Ex. E, *SCSI-3 Block Commands (SBC)*, ANSI NCITS 306-1998; Ex. C, *Fibre Channel – Gigabit Communications and I/O for Computer Networks*, by Alan F. Benner, McGraw-Hill, 1996, p. 17 (Figure 2.1 – Fibre Channel Structural Hierarchy).

18. In the example of Figure 3, when a program in a workstation 58 wants to access files, the local file system of the workstation translates file requests into SCSI-3 commands just as it would when accessing local files. Then the SCSI-3 commands (an NLLBP) are transmitted to the storage router using SCSI over Fiber Channel Protocol (SCSI FCP) as shown in the table above. In the system of Figure 3, storage router 56 does not have to translate a high level protocol (for example a network file system request in NFS/RPC or other network file system request) into an NLLBP to access storage.

19. In other more modern systems with remote storage, NLLBP commands can be transmitted using iSCSI with TCP/IP over an Ethernet serial network interconnect. In such a system, SCSI commands are encapsulated in messages delivered by TCP/IP over Ethernet to a storage subsystem. Network layers for accessing storage over Ethernet using SCSI-3 commands and iSCSI can be visualized as shown in Table 3, below:

<i>Network Layers</i>	<i>Typical usage</i>	<i>Purpose</i>
Network Application	iSCSI	SCSI-3 command for storage access
Presentation/Session		
Transport/Network	“datagram” delivery – addressing, routing, disassembly to and reassembly from packets (TCP/IP)	Encapsulate messages
Data Link / Physical	Data framing, hardware addressing, electrical signaling (Ethernet)	Deliver packets

Table 3

See e.g., Ex. K, *Internet Small Computer Systems Interface (iSCSI)*, Internet Engineering Task Force RFC 3720, April, 2004.

20. In an example of such a system, a storage subsystem extracts NLLBP SCSI-3 commands from the transport/network layer, and does not have to translate a high level protocol (for example, a network file system request in NFS/RPC or other network file system request) into an NLLBP to access storage.

21. In contrast to the system of Figure 1, the Patents-In-Suit describe that storage access in a system practicing the invention of the '035 Patent is accomplished efficiently:

tions more easily. This is accomplished without limiting the performance of workstations 58 because storage access involves native low level, block protocols and does not involve the overhead of high level protocols and file systems required by network servers.

Col. 5, ll. 1-5

22. A person of ordinary skill in the art at the time of filing would understand that “the overhead of high level protocols and file systems required by network servers” refers to the overhead associated with high level file system protocols (for example a network file system

request in NFS/RPC or other network file system request) that must be translated by a network server into low level requests to access storage.

23. The storage router of the Patents-In-Suit presents virtual local storage that appears to a host system to be locally connected to the host computer even though the storage is actually in storage devices that are remotely located. Consequently, the host system will access the virtual local storage using the NLLBP appropriate for storage that the host system sees as its local storage. The NLLBP that is appropriate for the virtual local storage is not necessarily the NLLBP appropriate to the remotely located storage devices.

Map/Mapping

24. The Patents-In-Suit state:

as virtual local storage. Storage router 56 allows the configuration and modification of the storage allocated to each
 15 attached workstation 58 through the use of mapping tables or other mapping techniques.

Col. 4, ll. 13-16.

25. Tables are one kind of data structure that can be used for mapping. A person of ordinary skill in the art at the time of filing would be aware of other data structures for mapping other than tables, including bitmaps, linked lists and trees. Additionally, a person of ordinary skill in the art at the time of filing would understand that a data structure for mapping can include multiple tables, including a set of tables coordinated with each other.

26. A person of ordinary skill in the art at the time of filing would understand that the map (comprising a table, set of tables or other mapping data structure) of the invention could be physically resident at storage router 56 or resident at another location (e.g., at management station 76).

Connected To/Connects

27. The Patents-In-Suit describe the use of a Fibre Channel Arbitrated Loop ("FC_AL"):

the Fiber Channel link. In one embodiment, the storage router provides a connection for Fiber Channel links running the SCSI Fiber Channel Protocol (FCP) to legacy SCSI devices attached to a SCSI bus. The Fiber Channel topology is typically an Arbitrated Loop (FC_AL).

Col. 5, lines 41-45.

28. Two examples of a Fibre Channel Arbitrated Loop including a storage router and several workstations are illustrated below:

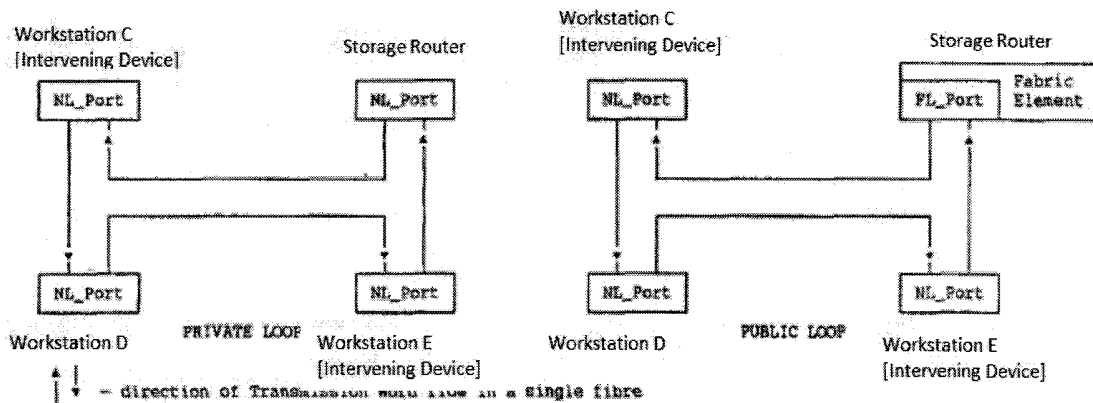


Figure 1 – Examples of the Loop topology

See Ex. D, *American National Standard for Information Technology-Fibre Channel-Arbitrated Loop (FC-AL)*, ANSI X3.272-1996, p. 6 (workstation, intervening device and storage router labels added for illustrative purposes).

29. In the FC-AL loop topology shown above, at least one device in the arbitrated loop (Workstation D in this illustration) is not directly attached to a link to the storage router, but instead is connected through an intervening device.

Remote

30. The '035 Patent describes traditional storage transport mediums.

Typical storage transport mediums provide for a relatively small number of devices to be attached over relatively short distances. One such transport medium is a Small Computer System Interface (SCSI) protocol, the structure and operation of which is generally well known as is described, for example, in the SCSI-1, SCSI-2 and SCSI-3 specifications.

Col. 1, ll. 22-27.

31. One of ordinary skill in the art at the time of filing would understand that parallel busses were typical storage transport mediums that provide for a small number of devices to be attached over a relatively short distance.

32. One example of a typical storage transport medium is a SCSI bus, which is a parallel bus. The SCSI-2 standard limits a SCSI bus to "a maximum cable length of 25 [meters]." Ex. H, *American National Standard for Information Technology-Small Computer Interface System-2*, ANSI 131-1994 (R1999), p. 8. However, it is my opinion that a 25.01 meter SCSI bus could be used to transfer data between a computer and a storage device and likely existed in the art at the time of filing.

33. Another example of a typical storage transport medium is a HIPPI bus, which a parallel bus. The HIPPI standard limits the length of a HIPPI bus to 25 meters. Ex. G, *International Standard for Information Technology – High-Performance Parallel Interface – Part 1: Mechanical, Electrical and Signaling Protocol Specification (HIPPI-PH)*, ISO/IEC 11518-1-1995, pp. 1, 24 (stating "the maximum cable length shall be 25 m (82 ft)"). It is my opinion that a 25.01 meter HIPPI bus cable could be used to transfer data between a computer and a storage device and likely existed in the art at the time of filing.

34. The Patents-In-Suit contrast high speed serial interconnects capable of supporting a large number of devices with typical storage transport mediums:

High speed serial interconnects provide enhanced capability to attach a large number of high speed devices to a common storage transport medium over large distances. One such

Col. 1, ll. 29-30.

35. The Patents-In-Suit further state:

controls. Network interconnects typically provide access for a large number of computing devices to data storage on a remote network server. The remote network server provides

Col. 1, ll. 46-50.

36. A person of ordinary skill in the art at the time of filing would understand that the Patents-In-Suit equate network interconnects with serial interconnects that can attach a large number of devices.

Storage Devices

37. Solid state storage devices using non-volatile memory and storage devices using volatile memory with battery backup were available at the time of filing. *See Ex. J, Storage Vendors Push the Capacity Envelope: Infoworld* October 27, 1997 Volume 19, Issue 43 p. 48. Therefore, a person of ordinary skill in the art at the time of filing would understand that a non-magnetic, non-optical storage device, including a storage device comprised of non-volatile and/or volatile solid state memory, could be used as a storage device of the Patents-In-Suit.

Virtual LUN

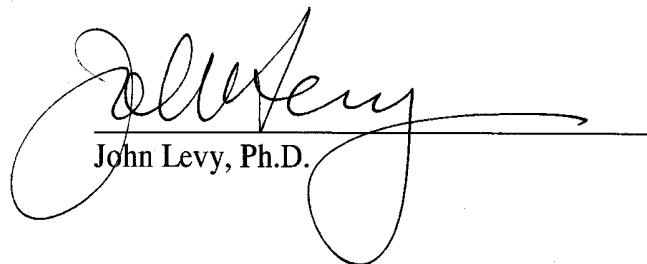
38. The Patents-In-Suit describe two types of LUNs. The first is the LUN of a physical storage device such as used in BUS:TARGET:LUN addressing. Col. 8, ll. 36-37. The second type of LUN is the LUN ("FCP logical units") used to represent virtual local storage to the

initiator devices. See Col. 5, ll. 50-53. An example of a map entry using such LUNs is illustrated below:

Host	Virtual Local Storage	Physical Storage
World Wide Name (WWN)	LUN 0	Bus:Target:LUN

39. A person of ordinary skill in the art at the time of filing, reviewing the claims in the context of the patent specification would have no trouble understanding that the phrase “virtual LUN” refers to a LUN used to represent virtual local storage. Furthermore, a person of ordinary skill in the art at the time of filing, reviewing the claims in the context of the patent specification would have no trouble understanding that an identifier used to identify virtual local storage in the map is a virtual representation of storage space.

I declare under penalty of perjury that the foregoing is true and correct and that this declaration was executed on March 7, 2011.



John Levy, Ph.D.

**UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
AUSTIN DIVISION**

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and Contained in Expandable Folder**

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Document/Attachment(s)**

Civil Case No. A-10-CA-652 SS

Crossroads Systems, Inc.

VS.

3Par, Inc., et al

Description: Exhibits to Expert Supplemental Declaration
 of John Levy, Ph.D

File Date: 3/8/11

Prepared by: MLC

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